The products discussed in this guide are intended for development and prototyping purposes as OEM subsystems for incorporation into customer’s prototypes and end products. Therefore, they do not comply with the appropriate requirements of FDA 21 CFR, section 1040.10 and 1040.11 for complete laser products.
Introduction

- The **Laser Scan and Camera Sense Demonstrator Kit** is a plug-and-play kit with a **MEMS-mirror based Scan Module**, **USB MEMS Controller**, and a **USB 3.0 Camera**.
  - Part Number: **DEMO-02**

- The kit is designed to demonstrate the capabilities of Mirrorcle’s MEMS mirror and controller with simple Windows based applications. Users may programatically steer a laser over a field of regard of $\sim 30^\circ \times 30^\circ$ and more. In conjunction with the camera it offers additional capabilities of tracking and addressing objects in camera’s field of view with a laser.
Laser Scan and Camera Sense Demonstrator Kit (DEMO-02)
What does the DEMO-02 Kit do?
**Camera Sense Mode** is named for the opto-mechanical setup to create an overlapping Field-of-View (FoV) of the MEMS scan module and Field-of-Regard (FoR) for the USB Camera.

- The entire MEMS Scan Module FoR fits within the Camera FoV, to create a pixel-to-angle look up table (LUT)
- The camera can identify objects in the field of view, and use the laser to illuminate the target

**Application Areas:**
- Augmented Reality, Security, Industry 4.0

**Go-To-Pixel demo** precisely moves the laser to a point clicked by the user in the camera’s FoV.

**Laser Pointer Tracking demo** showcases high-speed, high-precision tracking of a laser pointer. Users can illuminate the tracked target with programmable content (e.g. “SID”)
It Displays Vector Content

- Scanning text, arbitrary shapes, and vector content that can be streamed to the controller via USB from a Windows PC, or wirelessly from an Android device (requires Android Development Kit Add-On)

- **Vector Graphics Laser Projection (VGLP)** is the most efficient methodology for projecting high contrast and high brightness content onto arbitrary surfaces.

- Application Areas:
  - Laser marking, 3D printing, Dynamic Lighting, HUDs
What does DEMO-02 include?
Laser Scan and Camera Sense Demonstrator Kit (DEMO-02) - Contents

- **EaZy4.0G Scan Module** - optomechanical cell with mirror, laser and optics, designed to be driven by USB MEMS Controller
  - MEMS Mirror: A7M10.2-1000AL
  - Green laser module (520nm), set by Controller to ~10mW max.
  - Wide Angle Lens and optics with 30° optical FoV
- **USB 3.0 Camera** with 6mm lens (~45°x 34.5° FoV)
  - 720x540 pixels, capable of up to 500 fps
- Mechanical mounting for Camera and Scan Module
- **USB-SL MZ USB MEMS Controller**
  - PIC32MZ MCU and Embedded MEMS driver
  - USB powered and controlled by USB (software API) commands
- **Mirrorcle Software Suite + Camera Sense API**
  - Software Examples (C++) specific to DEMO-02
  - Comprehensive Documentation and Software Support Hours

Connect for Laser and MEMS driving

MEMS Mirror

Connector for Laser and MEMS driving

Laser Module

Projection Output

0 1cm 2cm
Block Diagram

Host PC (Windows)

USB 3.0 Camera

Scan Module

Opto-Mechanical Mount

USB-SL MZ MEMS Controller

MEMS

USB

Laser
Optical Diagram

Opto-Mechanical Mount placing Scan Module and Camera to have substantially overlapping FoVs.

Note: Camera FoV and Scan Module FoR do not share exactly the same origin which results in some accuracy error due to parallax, especially at shorter distances (<0.5m)
USB MEMS Controller vs. MEMS Driver

- A Controller converts software input commands to 4 high voltage outputs to command X,Y positions as well as to 8 low voltage digital outputs (trigger pins or M output). Mirrorcle’s USB-SL MZ MEMS Controller is designed for plug-and-play simplicity and is paired with an expansive, open application programming interface (API) for users to interact with the Controller and develop their own applications.
  - Mirrorcle’s USB-SL MZ MEMS Controller design is based on Microchip’s PIC32MZ MCU
- A MEMS Driver (here fully integrated inside the Controller) converts low voltage input commands (e.g. analog -10V to +10V from 2 inputs X,Y or digital SPI) to 4 high voltage outputs to command X,Y positions. Use of a MEMS Driver (as a general Mirrorcle product for OEM customers) instead of a Controller requires bench-top lab equipment such as function generators or a data acquisition (DAQ) card.
Mirrorcle Software Suite (“MSS”) has Windows Applications and software development kits (SDKs)

- **MTICamera-Demo**
  - Explore various key functions of the kit, including object or dot tracking, calibration, etc.

- **MirrorcleDraw**
  - Powerful Windows application to fully control the MEMS Mirror. (E.g. freehand and polyline sketches, parameterized mathematical curves, import of data files, text or clock output modes, raster patterns with various settings and a function generator with various settings)

- **MirrorcleLinearRaster**
  - Creates uniform velocity linear raster scans and controls the number of lines, points per line, line scan times, rotation etc. Possible to export raster scan data files (.kpt and .smp).

- **MirrorcleListDevices**
  - Scans the COM ports of the computer and provides a table of connected MTI devices with their properties.

- **MTIDevice-Demo**
  - Executable made from C++ SDK example code by the use of MTIDevice and MTIDataGenerator function calls.

For information on compatibility with other platforms such as Linux and other Add-On options, contact sales@mirrorcletech.com and/or browse the Development Kits overview document.
Mirrorcle Software Suite - SDKs

- **C++ based Software Development Kit**
  - The Software Development Kit (SDK) of the Mirrorcle Software Suite allows users to develop their own applications.
  - C++ API - The interface provides classes and functions for analog output, control of laser output, sample rate, filter settings, amplitude, device communication, etc.
  - An example Visual C++ project is provided to illustrate the use of the API and several ways of driving devices in point-to-point, rastering, and other modes.

- **Matlab-based Software Development Kit**
  - Similar to the C++ version, this is a Matlab-based software development kit (SDK) allows the user the fastest and easiest route to development of micromirror applications. Multiple examples included.
  - This SDK does not include Camera-related functionality, only MEMS Mirror control – it is included in this suite for general purposes.

- **LabView-based Software Development Kit**
  - Includes multiple examples of content generation (and content importing) and driving of MEMS mirror devices from National Instruments LabView software.
  - This SDK does not include Camera-related functionality, only MEMS Mirror control – it is included in this suite for general purposes.
**EaZy4.0G Scan Module**

- **MEMS Mirror**: A7M10.2-1000AL
- **Bandwidth**: ~2400Hz in LPF-based driving
- **FoR**: Approx. 30° x 30° Field of Regard
- **Wavelength**: Single laser diode source in:
  - Green (~520nm), up to 25mW CW power
- **Divergence (half angle)**: <2.25mrad
- **Repeatability**: <0.005° each axis
- **MEMS Interface**:
  - 10-pin 0.05” Samtec connector, mates with all Mirrorcle MEMS Controllers and Drivers outputs
- **Laser Interface**:
  - Shares 10-pin MEMS Interface connector (see above)
  - Direct access to Laser Diode terminals by header pins
  - Requires separate laser driver to control
- **Recommended Driving Parameters**:
  - \( V_{bias} = 90V \)
  - \( V_{differenceMax} = 140V \)
  - \( HardwareFilterBw = 2400Hz \)

The products discussed in this User Guide are intended for development and prototyping purposes as an OEM subsystem for incorporation into customer’s prototypes and end products. Therefore, they do not comply with the appropriate requirements of FDA 21 CFR, section 1040.10 and 1040.11 for complete laser products.
EaZy4.0 Scan Modules are powered by Mirrorcle’s fast **dual-axis quasi-static** MEMS Mirror A7M10.2-1000AL

Key features:
- 1mm Diameter (clear aperture)
- Aluminum thin film coating, very **high optical quality**
- Gimbal-less design optimized for **point-to-point** optical beam scanning
- **Fast** resonant frequency in both axes above 4 kHz
- Positional precision at least 14 bits on each axis
- **Highly repeatable** with no detectable de-gradation over time (>50,000 hr lifetime)
Pricing and Availability
Pricing and Availability

- Contact sales@mirrorcletech.com for a formal quotation with most up to date pricing and lead time
- Typical lead time is 4 Weeks
Thank You for Choosing

Additional Resources:

- Mirrorcle MEMS Mirrors – Technical Overview
- Mirrorcle Software Suite Applications – User Guide
- SDK and other documentation is available online at:
  https://www.mirrorcletech.com/documentation/
- Supporting documents, publications and sample device datasheets are available online:
  https://www.mirrorcletech.com/wp/support/